



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/057,674	01/24/2002	Jeng H. Hwang	AM-2602.C1	1101
32588	7590	10/03/2003	EXAMINER	
APPLIED MATERIALS, INC. 2881 SCOTT BLVD. M/S 2061 SANTA CLARA, CA 95050			BARRECA, NICOLE M	
		ART UNIT	PAPER NUMBER	
		1756	8	
DATE MAILED: 10/03/2003				

Please find below and/or attached an Office communication concerning this application or proceeding.

Offic Action Summary	Application No.	Applicant(s)
	10/057,674	HWANG ET AL.
	Examiner Nicole M. Barreca	Art Unit 1756

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) Responsive to communication(s) filed on 18 June 2003.
- 2a) This action is **FINAL**. 2b) This action is non-final.
- 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disp sition of Claims

- 4) Claim(s) 1-28 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) Claim(s) _____ is/are allowed.
- 6) Claim(s) 1-28 is/are rejected.
- 7) Claim(s) _____ is/are objected to.
- 8) Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) The specification is objected to by the Examiner.
- 10) The drawing(s) filed on _____ is/are: a) accepted or b) objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) The proposed drawing correction filed on _____ is: a) approved b) disapproved by the Examiner.
 If approved, corrected drawings are required in reply to this Office action.
- 12) The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) All b) Some * c) None of:
 1. Certified copies of the priority documents have been received.
 2. Certified copies of the priority documents have been received in Application No. _____.
 3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
 a) The translation of the foreign language provisional application has been received.
- 15) Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- | | |
|---|--|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____ . |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ . | 6) <input type="checkbox"/> Other: _____ . |

DETAILED ACTION

1. Claims 1-28 are pending in this application.
2. The present application was filed 1/24/02 and is a continuation of 09/421,467, filed 10/19/99. For examination purposes the application has an effective filing date of 10/19/99. While the present application is related through four CIP's to 09/006,092, filed 1/13/98, there are numerous claimed limitations in the present application not supported by the original disclosure of this parent case. For example 09/006.092 has no support for etching of any noble metal other than Pt, or etching the metal with any etchant gas selected from the group of a halogen containing gas, a noble gas, oxygen and mixtures thereof. (This first application discloses etching with a halogen containing gas **and** a noble gas, with optional additions of HBr and/or BCl3). There is also no support for an etch-stop layer (cl.19).

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

4. Claims 1, 10, 11, 13-16 are rejected under 35 U.S.C. 102(e) as being anticipated by Ye (US Patent 6,143,476).

Ye discloses a method for high temperature etching of materials such as copper, platinum, iridium, ruthenium and tungsten. Substrate 212 is a 1000 angstrom dielectric layer of silicon dioxide overlying a silicon wafer (not shown). A barrier layer 214 of tantalum nitride of approximately 500 angstroms thickness formed over the substrate 212. A conductive layer 216 (corresponding to the applicant's noble metal layer) of approximately 8000 angstroms is formed over the barrier layer 214, followed by a 500 angstrom layer 218 of tantalum nitride (corresponding to the applicant's inorganic protective layer in cl.1, 14 and inorganic first mask layer in cl.22). Ye teaches that conductive materials such as platinum, iridium and ruthenium may be used instead of copper (col. 6, 30-35, col. 10, 54-56). Organic masking layer 220 and silicon dioxide layer 222 (corresponding to the applicant's inorganic mask layer in cl.1, 13, 14, 19 and inorganic second mask layer in cl.22) is then deposited to a thickness of about 1000 angstroms, followed by patterned photoresist layer 224 (col. 8, 23-46). The pattern in the photoresist is transferred through layer 222 and layer 220 (applicant's step b). The photoresist layer 224 is then removed (step c). Optionally layer 222 may be removed also (step g). However if the thickness of the silicon dioxide layer is properly designed, this layer will be automatically removed during the patterning of feature layer 216. Barrier layer 218 and conductive layer 216 are then etched (steps d, e, f and h) using a feed gas of HCl, N₂ and BCl₃ at a temperature of about 250 °C. Layer 220 is then removed (step g). Other materials which may be used for the antireflective/barrier layers 214 and 218 include silicon oxynitride, tantalum, titanium nitride, tungsten titanate and tungsten nitride. See column 8, line 23 through column 10, line 56.

Art Unit: 1756

5. Claims 1, 10, 12-15, 17, 22 are rejected under 35 U.S.C. 102(b) as being anticipated by Yokoyama (US 5,515,984).

Yokoyama discloses a method for etching a PT film. NSG film 2 and Ti film 3 are formed on silicon substrate 1. TiN film 4 (barrier layer) is then formed, followed by Ti Film 5 and Pt 6 (noble metal). PZT film 7a (inorganic protective or first mask layer) is then formed, followed by SOG film 9 (inorganic (second) mask layer). SOG film (about 1 micron) is patterned with photolithography using a resist to obtain an etch mask. The SOG film is etched, followed by PZT film. The Pt film is etched using O₂ and Cl₂ at 300 °C (col.3, 26-col.4, 53). The TiN film may then be etched by changing the etching gas flow ratio (col.6, 5-13).

6. Claims 22, 23, 25-28 are rejected under 35 U.S.C. 102(e) as being anticipated by Kim (US 6,004,882).

7. Kim discloses a method for etching Pt film. Bottom layer 102, plug 104, barrier layer 106 of TiN and Pt layer 108 are formed on substrate 100. Adhesive layer 110 (400-800 angstroms) of Ti (first inorganic mask) and (second) mask layer 112 of an oxide (3000-6000 angstroms) are then formed, followed by a resist. The patterned resist is used to etch the mask layer, followed by etching of the adhesive layer. The Pt layer is then etched at 120-300 °C using O₂/Cl₂, O₂/HBr, O₂/Br₂ or O₂/Br. The barrier layer and substrate are then etched (col.3, 49-col.6, 8).

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

Art Unit: 1756

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

9. Claims 12 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ye.

Ye does not disclose that the (second) mask layer has a thickness of about 6000-9000 angstroms. Ye however does teach that the thickness of the silicon dioxide layer should be chosen so that it will be automatically removed during the patterning of metal feature layer 216 (i.e. result-effective variable). It would within the ordinary skill of one in the art to determine the optimal thickness for the (second) mask layer in the method Ye by routine experimentation and to have the thickness be about 6000-9000 angstroms, if required, because Ye teaches that when the thickness of the silicon dioxide mask layer is properly designed it will be automatically removed during the metal etch and the discovery of an optimum value of a result effective variable is ordinary within the skill of the art (*In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980)).

10. Claims 2-5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ye as applied to claim 1 above, and further in view of Hong (US Patent 6,046,113).

Ye is silent on if there is residual noble metal or residual protective material and does not disclose that this residual material is removed prior to etching the barrier layer. Hong teaches that residual layers remaining on the surface would interfere with later semiconductor processing (col.2, 26-29). It would have been obvious to one of ordinary skill in the art to remove the residual noble metal and residual protective layer in the

Art Unit: 1756

method of Ye because Hong teaches that residual layers will interfere with later semiconductor processing.

11. Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ye in view of Anderson (US 4,456,675) and Kornblit (US 5,948,570).

The teachings of Ye have been discussed above. Ye does not disclose that the silicon dioxide layer overlying the silicon wafer is an etch stop layer. Anderson teaches that silicon dioxide is a conventional etch stop material (col.9, 4-6). It would have been obvious to one of ordinary skill in the art that the silicon dioxide layer overlying the silicon wafer in the method of Ye was an etch stop layer because Anderson teaches that silicon dioxide is a conventional material used for etch stop layers.

Ye etches the noble metal layer using a halogen containing gas (HCl) and an additive of BCI₃, but does not disclose the etchant gas to also include a noble gas. Kornblit teaches that noble gas may be added to etchant gas mixtures in order to increase ion flux, stabilize the plasma or both (col.4, 33-41). It would have been obvious to one of ordinary skill in the art to add a noble gas to the etchant mixture of Ye because Kornblit teaches that that noble gas may be added to etchant gas mixtures in order to increase ion flux, stabilize the plasma or both.

12. Claims 6, 9, 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ye as applied to claim 1 above, and further in view of Kim (US 5,591,671).

13. Claims 7-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ye in view of Hong as applied to claims 2 or 4 above, and further in view of Kim.

Art Unit: 1756

14. Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ye in view of Anderson and Kornblit as applied to claim 19 above, and further in view of Kim.

Ye is silent on the deposition method used to form the silicon dioxide (second) mask layer and does not disclose that the mask layer is chemical vapor deposited (CVD) silicon dioxide. Kim teaches that CVD is a conventional method for depositing silicon dioxide (col.4, 29-30). It would have been obvious to one of ordinary skill in the art in the method of Ye, Ye in view of Hong or Ye in view of Anderson and Kornblit to deposit the (second) mask layer of silicon dioxide using CVD because Kim teaches that this is a conventional deposition method for this material.

15. Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ye in view of Anderson and Kornblit as applied to claim 19 above, and further in view of Kurino (US 5,613,296).

Ye discloses that the substrate includes a silicon dioxide layer (etch-stop) overlying the silicon wafer but does not disclose etching the etch stop layer (cl.20). Kurino teaches that forming conductive paths through two consecutive insulating layers at the same time permits the reduction in the number of patterning and etching steps (col.4, 57-61). It would have been obvious to one of ordinary skill in the art to etch the substrate, in the method of Ye in view of Anderson and Kornblit (including the silicon dioxide etch stop layer overlying the silicon wafer), at the same time as etching the barrier layer because Kurino teaches that this will reduce the number of patterning and etching steps.

Responses to Arguments

16. Applicant's arguments filed 6/18/03 have been fully considered but they are not persuasive.
17. The applicant argues that the Ye reference has an organic layer and therefore requires additional steps over those specified by the applicant to accomplish the same result. While it is true that Ye has an additional organic layer, the applicant's claims are written in open language and therefore is inclusive or open-ended and does not exclude additional, unrecited, elements or method steps. See MPEP 211.03.
18. In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., that the layer directly overlying the noble metal layer is inorganic) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993). (Please note that even if the applicant's claims did recite this limitation, Ye teaches an inorganic layer directly overlying the noble metal layer. Claim 22 was amended to recite that the second (inorganic) mask is **directly overlying** the first (inorganic) mask layer, and this is the reason that the Ye rejection was withdrawn).
19. With respect to claim 19 and dependent claims, in response to the applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of

references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

Conclusion

20. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action, with respect to claims 22-28. Applicant's submission of an information disclosure statement under 37 CFR 1.97(c) with the fee set forth in 37 CFR 1.17(p) on 8/13/03 prompted the new ground(s) of rejection presented in this Office action (Yokoyama). Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 609(B)(2)(i). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

21. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nicole M. Barreca whose telephone number is 703-308-7968. The examiner can normally be reached on Monday-Thursday (8:00 am-6:30 pm).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Huff can be reached on 703-308-2464. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.



Nmb



MARK F. HUFF
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1700